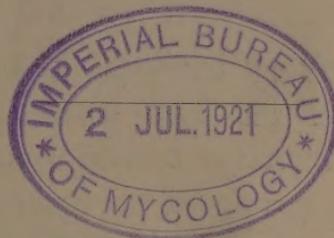


No. 55.

THE UNIVERSITY OF LEEDS,
AND THE
**YORKSHIRE COUNCIL FOR AGRICULTURAL
EDUCATION.**



A REPORT

ON

EXPERIMENTS WITH POTATOES,

1905.

J. G. Stewart

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* COUNTY * LECTURES. *



THE UNIVERSITY OF LEEDS, on behalf of the County Councils of the East, North and West Ridings of Yorkshire, will provide Courses of Instruction in the following subjects throughout the ensuing year:—

- I. Results of the Garforth and other experiments in the County.
- II. Agriculture.
- III. Horticulture.
- IV. Poultry Keeping.
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A REPORT

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EXPERIMENTS WITH POTATOES,

1905.

SCOPE OF EXPERIMENTS.

The scope of the experiments, other than manurial, conducted during the past year, is indicated by the following headings :—

1. The relative productiveness and quality of a number of Varieties of Potatoes.
2. The influence upon the crop of different methods of storing seed.
3. The relative merits of Immature and Mature seed.
4. Selection of seed from the most prolific plants.
5. The effect of manurial treatment upon the vigour of the Potato.
6. The planting of seed at different depths.
7. Diseases of the Potato.
8. Change of seed.

1. THE RELATIVE PRODUCTIVENESS AND QUALITY OF A NUMBER OF VARIETIES OF POTATOES.

Trials of Varieties of Potatoes have been conducted annually since 1898. Of the Varieties tested in 1898, however, only three were grown in 1905, the least profitable having been eliminated as the experiments progressed, and their places taken by other sorts. The three Varieties that have held their own during the past eight years are British Queen, Up-to-Date and Challenge, and, as their reliability for cropping and quality in all kinds of seasons is still so much greater than that of most of the newer sorts, they, and Potatoes of the Up-to-Date type, continue to rank amongst the most profitable which a farmer can grow.

Varieties tested in 1905. The test in 1905 included the following Varieties :—

British Queen, Challenge, Charles Fidler, Conquest, Discovery, Empress Queen, Evergood, Factor, Goodfellow, King Edward VII., Northern Star, Royal Kidney, Sir John Llewelyn, Up-to-Date and Up-to-Date No. 2.

The test, as in previous years, was duplicated in the County, and, through the kindness of Lord Wenlock, the duplicate test was again carried out on the Home Farm at Escrick.

Small quantities of new seed of all the Varieties tested in 1905 were procured in the Spring of 1904, as far as possible, from the raisers, and grown at Garforth in that year under the same manurial and soil conditions, the Varieties having been planted alongside each other in the same field. From the resulting crops, sufficient seed was obtained for the trials of 1905.

In this way, the varying effects upon the crop, in the first year, due to a change from different parts of the country to Garforth, are in a measure overcome, and a more reliable test of the merits of the Varieties is therefore possible in the second year.

Manurial Treatment. At Garforth, the test was conducted in Field 36, the soil of which is a medium loam. The previous crop was barley, following oats. Neither the oat crop of 1903, nor the barley of 1904, received any manurial dressing whatever. Very good corn crops were grown in each year, and, in consequence, the land was left in a comparatively exhausted state, a condition none the less suitable for trial purposes.

The following manures were applied in the rows before planting :—

10 tons Dung per acre.

1 cwt. Sulphate of Ammonia per acre.

1 cwt. Muriate of Potash per acre.

The cost of the Artificials amounted to 23/4 per acre. It will be seen that no phosphates were included in the mixture of artificial manures. Super-phosphate, or some other form of phosphatic manure, has generally

been considered indispensable in growing Potatoes with the aid of only a moderate dressing, say 10 tons, of dung. The manurial experiments, however, conducted in Yorkshire from 1899 to 1903, indicate that a mixture of artificials containing nitrogen and potash, along with a moderate dressing of dung, is usually sufficient to produce a satisfactory crop.

At **Escrick**, the soil is a strong-bodied sand. In Autumn, 1904, dung at the rate of 14 or 15 loads per acre had been applied to the field and ploughed in. In early Spring the land was ridged, and the following mixture of Artificials applied broadcast on the ridges:—

1 cwt. Sulphate of Ammonia	per acre.
4 cwts. Kainit	"
1½ cwts. Rape Meal	"

The cost of this mixture would be about 28/- per acre.

Here again it will be noticed that no phosphates were used further than those contained in the rape meal and the dung.

The dung, both at Garforth and Escrick, was made in covered yards.

Dates of Planting. The Potatoes were planted at **Escrick** on April 8th, and at **Garforth** from May 12th to 16th.

Particulars regarding the Seed. The seed used in both experiments, was stored at Garforth throughout the winter in boxes, this being at once the most convenient method of dealing with small quantities of a number of Varieties, and also, in the light of past experience, the most profitable. The following notes were taken at planting time:—

Escrick. The bulk of the Varieties have scarcely begun to sprout. On the Second-Earlies, the sprouts in no case exceed $\frac{1}{4}$ in. in length, and $\frac{1}{8}$ in. is probably the average.

Garforth. The Second-Earlies have sturdy sprouts, fully $\frac{3}{4}$ in. long. On the late Varieties, the average length does not much exceed $\frac{1}{4}$ in. King Edward VII. and Discovery have barely started to sprout at all."

Whole tubers, slightly less in size than a hen's egg, were used as seed, and care was taken that the sprouts were not damaged, and that no unsound tuber of any Variety was planted. Freedom from blanks in the crop was thus secured.

At both places the tubers were planted direct from the boxes and covered the same day; the width of the rows was 28 in., and the distance between the sets, from 13 to 14 in.

Dates of Lifting. At **Garforth** the Varieties were lifted as they became ripe, the process extending from October 5th to 18th.

At **Escrick** all the sorts were lifted on the same day, viz.:— November 4th, it being impracticable there, to lift the Second-Early before the late Varieties.

RESULTS OF THE TEST.

The appended table gives the yields of the Varieties per acre, arranged in the order of cropping at Garforth, together with the percentage weight of ware, and the weight of diseased tubers.

It will be seen that some Varieties have yielded double the crop of others, and in many cases there are differences of several tons per acre. Moreover, the order of merit is in fair agreement at both centres. The five Varieties that have yielded best at Escrick also head the list at Garforth. Again, the poorest cropper is the same at both places, viz.:—Northern Star.

Without doubt, these facts indicate that the choice of variety is a most important factor in successful Potato growing. It is to be noted from these results, that most of the Varieties that have been on the market for a number of years have cropped better than the majority of the more recent introductions.

Discovery and Northern Star have cropped badly, but it should be stated that, as the seed of both was rather expensive, small quantities only were purchased in the spring of 1904, and measures were taken to make the most of them. The Varieties were cut into numerous sections, and the resulting crops furnished the seed used in 1905.

Larger quantities of seed of the other Varieties were purchased, and only the very biggest tubers were cut, and then only into two sets, so that it is just possible the excessive cutting practised with Discovery and Northern Star in 1904, may in some measure be responsible for the poor crops in 1905.

Discovery is a very late variety. It makes slow progress at the beginning of the season, and the tops remain green long after other Varieties are ripe. The tubers are shapely and of good size, and it is hoped a fairer test of its cropping powers may be made next season.

There were no blanks with Northern Star, but at both centres it was early seen that the vigour of individual plants varied, and later in the season there seemed to be more than one distinct type of Potato. The crops of this Variety consisted mostly of small tubers, practically half being "seed" and "chats." (See percentage of ware, Table I.).

Other Varieties that yielded a rather small proportion of marketable Potatoes were Royal Kidney, King Edward VII., and Goodfellow.

Sir John Llewelyn is the earliest Variety of all those tested and is ready for lifting some weeks before British Queen. Strictly speaking, however, it cannot be regarded as a First Early.

On the whole, the Varieties have cropped better at Escrick than at Garforth. At the former centre the soil is pre-eminently suited for Potatoes, and moreover, the previous cropping there was of a less exhaustive nature than at Garforth.

TABLE I.

Name of Variety.	Shape of Potato.		YIELD PER ACRE.														
			Garforth.						Escrick.								
			Date of Lifting.	Total Crop per Acre.			Per-cent-age of Ware.	Weight of Diseased Tubers per Acre.			Total Crop per Acre.			Per-cent-age of Ware.	Weight of Diseased Tubers per Acre.		
				Tons.	cwts.	qrs.		cwts.	qrs.	lb.	Tons.	cwts.	qrs.		cwts.	qrs.	lb.
Challenge ...	S.R.	S.E.	Oct. 6	13	15	1	81	1	3	4	13	16	2	85	22	2	0
British Queen ...	S.R.	S.E.	Oct. 5	12	19	0	71	—	—	—	15	16	3	86	17	0	16
Conquest ...	R.	S.E.	Oct. 6	12	7	1	73	1	0	8	13	10	1	85	15	0	0
Royal Kidney ...	K.	L.S.E.	Oct. 10	12	2	2	67	—	—	—	12	18	2	78	6	0	8
Factor	S.R.	L.	Oct. 12	11	6	2	75	4	1	4	—	—	—	—	—	—	—
Charles Fidler ...	R.	L.	Oct. 17	10	19	1	75	3	3	20	12	10	3	90	3	2	8
Evergood ...	S.R.	L.	Oct. 11	10	14	3	71	—	—	—	9	14	1	80	1	0	8
Up-to-Date No. 2	S.R.	L.	Oct. 18	10	10	1	70	5	0	0	12	10	1	91	6	0	8
Empress Queen ..	K.	L.	Oct. 17	10	5	3	72	—	—	—	—	—	—	—	—	—	—
Up-to-Date ...	S.R.	L.	Oct. 18	10	2	2	70	5	1	12	10	18	1	88	5	2	24
Goodfellow ...	R.	L.	Oct. 12	8	7	1	64	0	1	12	8	5	0	71	—	—	—
Sir John Llewelyn	K.	E.	Sept. 25	8	2	2	68	—	—	—	—	—	—	—	—	—	—
King Edward VII.	K.	L.	Oct. 12	7	14	0	73	—	—	—	9	0	0	77	5	0	0
Discovery ...	K.	L.	Oct. 17	5	17	1	70	—	—	—	—	—	—	—	—	—	—
Northern Star ...	R.	L.	Oct. 17	5	11	3	46	—	—	—	4	14	1	59	3	0	24

S.R., Semi-Round; K., Kidney; R., Round; E., Early; S.E., Second-Early; L.S.E., Late Second Early; L., Late.

Presence of Disease.—The table shows that disease was much more prevalent at Escrick than at Garforth. It must be remembered, however, that none of the Varieties at Escrick were lifted until November 4th, whilst at Garforth lifting began with the earliest sorts on October 5th, and all were lifted by October 18th. Again, the Varieties at Escrick were planted fully a month before those at Garforth, and were quite ripe long before they were lifted—lifting operations at Escrick having to be postponed owing to pressure of other work on the Farm. The greater amount of disease at Escrick is doubtless in large measure due to the lateness of lifting. The figures relating to disease, however, are useful in showing which Varieties have the greatest disease-resisting powers, and Evergood, Goodfellow, and Discovery take the lead in this respect. British Queen, Challenge, and Conquest had a big proportion of diseased tubers at Escrick, but the same sorts at Garforth, lifted at the proper time, were not at all badly diseased.

The conclusion, therefore, is that these older sorts, provided they are lifted as soon as ripe, are still unsurpassed as Varieties for field culture.

Cooking Quality of Potatoes. The character of the soil has undoubtedly an important influence on the quality of Potatoes, and whilst the figures in the table may represent pretty nearly the relative cooking merits of the Varieties on the medium loam soil at Garforth, it is probable that somewhat different results would be obtained on soils of different character.

Medium-sized tubers were selected for the cooking test, which was carried out on January 5th and 6th, 1906.

The Potatoes were peeled, and cooked whole.

The figures for 1904 are also given, and it will be seen that there is a fairly close agreement in the relative positions of those Varieties tested in both years.

Most of the Varieties have cooked satisfactorily, and only the last five in the table can be regarded as second-rate sorts.

Langworthy, however good its reputation may be in some parts of Britain, has at Garforth proved disappointing, both as a cropping and a cooking Potato. The flavour was good, but the Potato after standing some time assumed a dark grey colour.

VARIETY.	COLOUR.	FLAVOUR.	FLOURINESS.	Total Marks 1905.	Total Marks 1904.
	Maximum Marks 15.	Maximum Marks 20.	Maximum Marks 15.	Maximum 50.	Maximum 50.
British Queen ...	12	20	15	47	47
King Edward VII....	13	20	13	46	43
Northern Star ...	13	19	14	46	46
Wonder	15	17	14	46	...
Discovery	14	17	14	45	44
Factor	14	16	15	45	...
Up-to-Date	14	16	15	45	44
Up-to-Date, No. 2 ...	14	16	15	45	44
Conquest	15	16	13	44	43
Duchess of Cornwall	14	16	14	44	...
Sir John Llewelyn ...	13	18	13	44	45
Charles Fidler ...	14	19	10	43	45
Dalmeny Beauty ...	12	17	13	42	...
Empress Queen ...	12	17	13	42	44
Royal Kidney ...	10	16	12	38	40
Challenge	10	16	10	36	38
Eldorado	9	17	10	36	...
Evergood	8	16	12	36	35
Langworthy ...	5	16	10	31	...

2. THE INFLUENCE UPON THE CROP OF DIFFERENT METHODS OF STORING SEED.

(1) Storing in Boxes in Autumn.

This method, which consists in placing the seed tubers in boxes instead of in "pies," was tried at Garforth for the first time in 1901, and has, since then, been the method chiefly used for the storing of seed. Seed stored in this way has almost invariably given more profitable results than seed planted direct from the pie. There are certain drawbacks, however, to the general adoption of the system. Autumn is usually a very busy time with most farmers, and perhaps the most expeditious way of dealing with Potatoes is simply to pie them. Again, storage room for potato boxes is lacking on most farms, and even if room can be found there is a risk of the Potatoes in boxes being damaged in a time of severe frost, unless the precaution is taken of covering the boxes with canvas-sheeting or straw. This system has been practically superseded by another, now to be described.

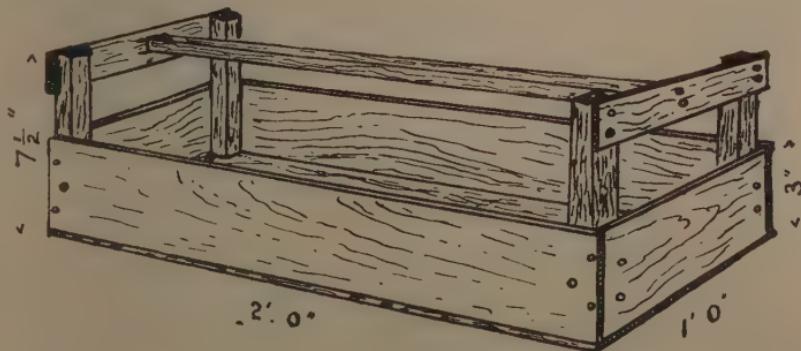
(2) Storing in Boxes during Winter or early Spring.

This method has a distinct advantage over the first in that the Potatoes may be left in pies until sprouting begins in early Spring, if it has not been found convenient during the Winter to remove them to boxes.

This method has given quite as satisfactory results as the one first described, and both have proved superior to planting direct from the pie.

"Greening" of the seed tubers is secured by the first method, but this appears to have little or no influence upon the yield. The main point to be attended to, is the removal of the tubers from the pie in Spring before the sprouts are much developed.

Arrangement of Tubers in Boxes.—In boxing Potatoes, the plan has been to place the tubers in a single layer with the crown end, or ends which contain most eyes, upper-most. This, however, entails a great amount of labour. Furthermore, the box recommended, and illustrated below, will then hold only about 14 lb. of tubers.



Taking the cost of the box at 4½d. (the price in 1904), and estimating 15 cwt. as the usual quantity of seed planted per acre, 120 boxes will be necessary per acre, at a cost for boxes of 45/- Judging, however, from some experiments in 1904 and 1905, the extra labour and expense involved in arranging the tubers in a single layer in the boxes do not appear to be justified. Hitherto, it has been almost universally believed that the crown eyes of Potatoes produced the most vigorous plants and the best crops, hence the reason for encouraging the crown eyes at the expense of the side eyes, by placing the tubers with the crown ends uppermost. In 1904, however, the following experiment was conducted. Ten tubers of Northern Star were selected, and from each were cut one distinct crown eye and one distinct side eye. The result was as follows :—

Crown eyes,	10 sets	yielded	20 lb.
Side	" 10 "		27 lb.

In 1905, this experiment was repeated with Northern Star and another Variety—Conquest.

Northern Star,	10 sets, crown eyes,	yielded	7 lb.
"	10 " side	" "	7 lb.
Conquest,	10 " crown	" "	11 lb.
"	10 " side	" "	12 lb.

The weights from these two Varieties, in 1905, are undoubtedly small, but at all events they tend to show that crown eyes are not superior to side eyes.

In addition to these minor tests, seed of two Varieties—British Queen and Evergood—was tumbled into boxes, regardless of any particular arrangement. A box then holds about 20 lb. of seed tubers, and the cost in boxes per acre will not exceed 31/6. The result of this test was as follows :—

Variety.	Seed set up in Boxes.			Seed boxed but not set up.			Balance in favour of setting up on end.	
	T.	c.	q.	T.	c.	q.	c.	q.
British Queen ...	12	19	1	12	17	3	1	2
Evergood ...	10	14	3	10	4	1	10	2

The advantage from the setting up of the tubers in the case of both varieties is very little, and, considered in conjunction with the results from crown eyes and side eyes, scarcely warrants the extra labour and expense of placing the seed with the crown ends uppermost.

(3) Planting direct from the Pie.

This is the method usually practised, and was for the first time compared in 1903 with the two methods already described.

	T.	c.	q.	
Up-to-Date, boxed in Autumn ...	13	17	3	per acre.
" " Spring ...	13	18	1	"
" planted direct from the pie... 11	17	3	"	
Advantage of boxed over pied seed	2	0	0	"

The above seed was taken from stock that came from Scotland in the Spring of 1902. The pie from which the tubers were planted on

May 20th contained several tons of Potatoes, and it should further be noted that the pie was uncovered only a few days before planting.

The following results obtained in 1904 are extracted from Report No. 48:—

VARIETY.	Seed “boxed” in Autumn.	Seed “boxed” in Spring.	Seed planted direct from “Pie.”	Advantage of Autumn- prepared Seed over Seed planted from “Pie.”	Advantage of Spring- prepared Seed over Seed planted from “Pie.”
British Queen ...	Tons cwts. qrs. 12 16 2	Tons cwts. qrs. 13 7 1	Tons cwts. qrs. 12 0 0	Tons cwts. qrs. 0 16 2	Tons cwts. qrs. 1 7 1
Empress Queen	13 5 1	13 9 3	9 3 3	4 1 2	4 6 0
Evergood ...	14 10 2	14 15 3	13 2 2	1 8 0	1 13 1
Up-to-Date ...	14 8 3	13 7 2	13 1 1	1 7 2	0 6 1
Up-to-Date No. 2	12 8 1	12 16 2	12 2 2	0 5 3	0 14 0

“Although the average advantage from five varieties in 1904 is somewhat less than that from the single Variety (Up-to-Date), in 1903, it should be noted that the seed for the test in 1903 was taken from a pie containing several tons of Potatoes, whereas the pies for the 1904 test were, of necessity, small, containing indeed only 500 tubers each. In these circumstances, heating or sweating could not take place to any great extent, and the cool condition of the pies discouraged sprouting. Moreover, the Potatoes were planted some ten days earlier than in 1903, so that, all things considered, it was only to be expected that the difference would be less marked in 1904.”

In 1904 the advantage due to boxing was decidedly more marked when boxed seed was tested against seed taken from a large pie.

		T.	c.	q.	
New seed from Scotland (1903)	boxed in Autumn	14	8	3	per acre.
“	“	13	7	2	“
“	“	11	18	2	“
Average advantage of boxed over pied seed	...	I	19	2	“

In preparation for the experiments of 1905, small quantities of seed of the Varieties mentioned in the table below were stored in one long narrow pie in the Autumn of 1904, the Varieties being separated from each other by layers of straw. On March 28th, 1905, the soil was removed from the pie, and the condition of the seed as to sprouts, &c., will be gathered from the following notes taken on that date:—

"In all cases the condition of the seed is excellent. Goodfellow and King Edward VII. have scarcely started to sprout, whilst the sprouts on Evergood, Charles Fidler, Empress Queen and Up-to-Date No. 2 are on the average only about $\frac{1}{8}$ in. long. On Conquest and Challenge they vary in length from $\frac{1}{4}$ in. to $\frac{1}{2}$ in., and on British Queen they would average at least $\frac{1}{2}$ in., many indeed being $1\frac{1}{2}$ in. long."

The tubers for the experiment at **Escrick** were removed from the pie on April 4th, and were planted on April 8th. What remained were covered with straw until May 12th, when the following notes were taken just before the Potatoes were transferred to boxes, for planting at Garforth.

British Queen : Sprouts chiefly localised at crown end, $\frac{1}{2}$ in. long.

Challenge } Sprouts $\frac{1}{2}$ in. to 1 in.; excellent samples.
Conquest }

Royal Kidney : Sprouts 1-2 in., somewhat drawn.

Evergood
Goodfellow } Sprouts $\frac{1}{4}$ in. to $\frac{1}{2}$ in.
Up-to-Date No. 2 }

Charles Fidler : Just beginning to sprout.

King Edward VII. : Very backward in sprouting.

The sprouts on all the Varieties were quite pale.

The Potatoes were planted at **Garforth** on May 12th-16th.

TABLE II.

VARIETY.	GARFORTH.			ESCRICK.			GARFORTH.	ESCRICK.
	Seed Boxed.	Seed planted direct from pie.	Seed Boxed.	Seed planted direct from pie.	Advantage + Disad- vantage - of "Boxing."	Advantage + Disad- vantage - of "Boxing."		
Challenge ...	T. 13 15 1	c. 12 6 0	q. 13 16 2	T. 13 5 3	+1 9 1	T. +0 10 3	c. -0 8 0	q. 0 0 0
British Queen	12 19 0	12 15 0	15 16 3	16 4 3	+0 4 0	-0 8 0	-0 8 0	0 0 0
Conquest ...	12 7 1	11 7 3	13 10 1	13 9 0	+0 19 2	+0 1 1	+0 1 1	0 0 0
Royal Kidney	12 2 2	11 17 3	12 18 2	11 8 1	+0 4 3	+1 10 1	+1 10 1	0 0 0
Charles Fidler	10 19 1	10 16 2	12 10 3	14 10 1	+0 2 3	-1 19 2	-1 19 2	0 0 0
Evergood ...	10 14 3	9 0 2	9 14 1	9 9 3	+1 14 1	+0 4 2	+0 4 2	0 0 0
Up-to-Date, No. 2 ...	10 10 1	10 15 1	12 10 1	16 13 1	-0 5 0	-4 3 0	-4 3 0	0 0 0
Goodfellow ...	8 7 1	5 17 1	8 5 0	6 10 3	+2 10 0	+1 14 1	+1 14 1	0 0 0
King Edward VII. ...	7 14 0	9 4 3	9 0 0	8 17 3	-1 10 3	+0 2 1	+0 2 1	0 0 0

Neglecting at both centres King Edward VII., the results from which Variety are obviously misleading, seven of the Varieties tested at **Garforth** show an average advantage of just over one ton of Potatoes per acre in favour of boxed seed.

Up-to-Date No. 2, on the other hand, shows a disadvantage of 5 cwt.s. per acre from boxed seed.

Charles Fidler and British Queen show very slight, perhaps negligible, advantages due to boxing.

Taking **Escrick**, where the Varieties were planted five weeks earlier than at Garforth, five Varieties show an average advantage of 16 cwt.s. per acre from the use of boxed seed, but this is discounted by the disadvantages arising out of boxing in the case of three other Varieties.

It is worthy of note that the three Varieties which at Garforth have shown either little or no benefit from boxing, are the three which at Escrick show disadvantages.

This is interesting, as the three in question are all old-established sorts, and are evidently better able to stand rougher treatment than some of the more recently introduced kinds.

The sum and substance of the matter would appear to be briefly this—if the Potatoes are planted early it is of little consequence whether the seed has been boxed or taken direct from the pie. It must, however, be borne in mind that in these experiments—

1. The pie from which the seed was taken was small, and a considerable amount of ventilation was secured by the straw divisions. In consequence, the sprouting of the tubers was less advanced than would have been the case in a pie of ordinary dimensions.

2. The Varieties were transferred from the pie to boxes and planted from the boxes, care being taken that, in handling, as little damage as possible was done to the sprouts.

There can be little doubt that loss is sustained in dealing with seed Potatoes that have sprouted in the pies, but such loss in ordinary farm practice is almost unavoidable. The following test has an important bearing on this point :—

The bulk crop at Garforth in 1904 was Up-to-Date grown from new Scotch seed. The produce was stored in Autumn in a pie of the usual size and shape. In March, 1905, the soil was stripped off, and the Potatoes remained covered only with straw till the end of April, when a selection of seed-size tubers was made. At this date the sprouts on the Potatoes were, on the average, about $1\frac{1}{2}$ in. long, and were very tender. For a test, two separate lots of seed were selected. One lot was carefully transferred to boxes without injury to sprouts, whilst the sprouts of the other lot were **r ubbed off** before the tubers were placed in boxes. The Potatoes were planted on May 15th, and, as will be seen from the figures, the removal of the sprouts has adversely affected the yield

	Tons.	cwts.	qrs.	
Up-to-Date—sprouts rubbed off . . .	8	17	3	per acre.
, , sprouts not rubbed off ...	10	2	2	,

A similar test was conducted at Escrick, where, as already stated, the Potatoes were planted fully five weeks earlier than at Garforth. Growth in the pies at that date had not advanced far, and the removal of tiny sprouts has not been detrimental:—

	Tons.	cwts.	qrs.	
Up-to-Date—sprouts rubbed off ...	12	10	3	per acre.
, , sprouts not rubbed off ...	11	19	0	,

It is doubtless common knowledge that tubers in a pie show various degrees of sprouting, especially in early Spring. Some may have sprouts several inches long, whilst others may have scarcely begun to sprout, if at all. The latter would, of course, suffer no damage by handling at planting time, but it would appear that nothing is to be gained by selecting such tubers for seed. The shyness in sprouting is probably due to some inherent weakness in the tuber that persists in the crop throughout the entire season of growth. Up-to-Date seed of this description yielded at Escrick 11 tons 9 cwts. 1 qr., whilst more precocious seed from the same pie yielded 11 tons 19 cwts.

Where large areas of Potatoes are planted, the question of providing sufficient boxes for the seed and of finding accommodation for the same, is a serious one, but it ought to be generally possible to box the earlier-sprouting Varieties.

If it be found impracticable to box late or main-crop Varieties, it is at least preferable to spread the seed in a thin layer on the floor of a dry, well-lighted shed to leaving it in pies till planting time.

The free admission of light is important. It has the effect of retarding growth, with the result that only short and sturdy sprouts are produced which are much less liable to be knocked off at planting time than the pale, elongated sprouts produced in the dark.

3. THE RELATIVE MERITS OF IMMATURE AND MATURE SEED.

That Scotch seed does well in Yorkshire is generally admitted, but why this should be so is not quite clear. A number of influences are probably at work. The Potato growing season in many parts of Scotland is somewhat shorter than the Yorkshire season, and very often this necessitates the lifting of the crops in Scotland before the tubers are as well matured or ripened as in Yorkshire, or other parts of England.

Now if, through the nature of the climate, the foliage of Potatoes is damaged before the tubers have reached their full size, there will be fewer actually big Potatoes in the produce, and, as a consequence, a better selection of seed will be possible. In other words, the farmer will be using for seed a certain proportion of tubers which, had they had time to grow to their full size, would have passed to the market as ware or saleable stuff. It is possible that a big Potato has more "constitution"

than a small one, and consequently a small Potato, not yet arrived at its full growth—in brief, *immature*—may contain more innate vigour than a small yet fully mature Potato which may have been the produce of a weakling. Granting, then, that the proportion of ware is greater in English than in Scotch grown crops, it is only reasonable to suppose that, in the seed, the proportion of weakling tubers is the greater in English crops. Moreover, the proportion of small tubers will tend to increase from year to year, since the practice of retaining for seed, small Potatoes, insures that practically the entire produce of weakly plants every year falls into the “seconds” or seed-size class.

This may to some extent explain why in England it becomes necessary to change the seed about every second year, and why Scotch seed does so well in England.

There is yet another point. In Spring, the Scotch seed is slower in sprouting than the English, and therefore runs less risk of damage.

Sometimes big Potatoes are cut for seed, and where this practice prevails it would seem that change of seed need not be so frequent.

To provide for a test, in 1905, of seed in two stages of ripeness, seed of the Varieties mentioned below was lifted (1) in **immature and (2) in mature condition.**

To obtain seed in an immature state, small quantities were lifted while the tops were still green and the skins of the tubers tender. To get mature seed, the Varieties were lifted at the usual time, when the tops had died down and the skin on the tubers had become tough.

The following table is interesting as showing the difference in the yields between ripe and unripe crops. It was from these crops that the seed was selected for the test of mature and immature seed in 1905.

Unfortunately the yield of the Second-Earlies lifted when unripe was not determined.

VARIETY.	IMMATURE.			MATURE.		
	Date when lifted.	Yield per acre.		Date when lifted.	Yield per acre.	
British Queen ...	Sept. 13th, 1904	T. c. q.	...	Oct. 18th, 1904	T. c. q.	...
Royal Kidney...	„ 15th, „	...		„ 28th, „	...	
Charles Fidler...	„ 27th, „	12 16 1		„ 28th, „	13 5 0	
Empress Queen	„ 27th, „	12 4 1		„ 28th, „	12 11 3	
Up-to-Date ...	„ 28th, „	13 11 0		„ 31st, „	14 13 3	

Lifting the crop to obtain seed in an unripe or immature state has naturally resulted in a diminished yield per acre. It is just possible, however, that the slightly higher price generally obtainable in the earlier

part of the season would counterbalance the shortage in yield through the early lifting, that is, if the farm were situated conveniently near a suitable market.

The immature and mature seed, obtained in the manner described, were stored in boxes under the same conditions throughout the Winter and Spring, and at planting time both were in excellent condition. There was comparatively little difference between the length of the sprouts of the two lots, but if anything, the sprouts of the immature seed were slightly the shorter.

The test was carried out with whole sets, and, in the case of two Varieties, with cut sets in addition.

VARIETY.	YIELD PER ACRE.								Balance in favour of Immature Seed.						
	From Immature Seed.			From Mature Seed.											
	Whole Sets.		Cut Sets.	Whole Sets.		Cut Sets.	Whole Sets.		Cut Sets.	Whole Sets.		Cut Sets.	Whole Sets.		
	T.	c.	q.	T.	c.	q.	T.	c.	q.	T.	c.	q.	T.	c.	q.
British Queen ...	12	11	3	12	0	0	11	13	1	11	1	3	0	18	2
Royal Kidney ...	13	1	3	12	11	3	11	11	2	12	2	1	1	10	1
Charles Fidler ...	10	18	1	11	12	2	10	19	1	...			<i>Nil.</i>		...
Empress Queen..	11	0	3	9	19	1	10	5	3	..			0	15	0
Up-to-Date ...	10	4	3	10	14	1	10	2	2	...	0	2	1		...

Whole Sets.—Better crops have been obtained from immature seed in the case of all the Varieties except Charles Fidler. The advantage gained, however, with whole Sets, amounts on the average to only 13 cwts. per acre. It will be noted that the most pronounced advantages have been got with British Queen and Royal Kidney, the seed of which was selected from stock that had already been grown twice on the farm, whereas the seed of the other Varieties was selected from stock that had been grown only once.

Cut Sets.—*Immature* tubers cut, also gave slightly better crops than mature tubers cut, the average advantage being $13\frac{3}{4}$ cwts. per acre.

Whilst the use of immature seed has so far proved beneficial, lifting, for seed purposes, Potatoes with strong green tops, will not, it is feared, be found generally practicable. The immature seed would doubtless keep well enough in boxes, but it is questionable whether it could be pied in quantity without considerable loss. Provision has been made for testing this point.

Were immature seed to show any marked superiority over mature seed it might be possible to raise sufficient seed by planting a late patch, say some time in June. This was done, on a small scale, at Garforth in 1905. Three Varieties, viz., Charles Fidler, Wonder, and Up-to-Date were planted on June 24th alongside seed of the same Varieties planted on May 16th and 17th. They were all lifted on October 18th and 19th, and the yields per acre are given in the following table:—

Variety.	Date of Planting.	Yield per Acre.		
		T.	c.	q.
Charles Fidler ...	May 16th	6	19	1
" "	June 24th	4	2	2
Up-to-Date ...	May 17th	10	5	3
" "	June 20th	6	9	3
Wonder ...	May 16th	11	13	2
" ...	June 24th	6	15	0

The two Varieties, Charles Fidler and Wonder, have now been grown four times on the farm without change of seed, and Up-to-Date three times.

The late planting has resulted in greatly reduced yields, but there would appear to be little doubt as to the keeping qualities of the immature seed raised in this way, even under the ordinary pie conditions. On account of frost and other influences the tops were quite dead at lifting-time, and they in no way retarded the lifting operations. Moreover, the tubers, for the most part "seed size" and "small," were in excellent condition, and their skins were quite tough enough to resist rubbing. The proportion of disease was the larger in the late-planted Potatoes.

Seed obtained by the above two methods will be tested in 1906.

4. SELECTION OF SEED FROM THE MOST PROLIFIC PLANTS.

Selection has undoubtedly played an important part in the improvement of plants of all kinds, but so far it has received comparatively little attention from the ordinary farmer. With regard to Potatoes it is well known that selection for form is unsatisfactory, as the shape of the tuber is modified by soil and season. Ill-shaped Potatoes are frequently grown from shapely seed. Again, if by selection is sought a plant of a permanently different type, it need be attempted only when all the tubers of a plant show a uniform divergence from the general crop, accompanied also by a similar diversity in type on the part of the foliage. By continuous planting and selection on these lines, a slightly different plant might result. From the growers' standpoint, however, it would appear that if selection is to be practised at all it must be for productiveness.

In the Autumn of 1904, a quantity of "seed" and "ware" was specially selected from the most productive roots found among the Varieties grown for the *first* time on the farm. Only a small area of each Variety was planted, and as the entire produce of the most prolific plants was kept on one side, and afterwards tested against the residue, the trial may justly be regarded as a severe one.

The selected tubers were stored in boxes throughout the Winter and Spring under the same conditions as the tubers against which they were to be tested. The crops, calculated to yield per acre, from the two lots of seed, were as follows:—

VARIETY.	SEED NOT SELECTED.			SEED SELECTED.								
	Seed-size Whole Sets.			Seed-size Whole Sets.			Medium Ware, Cut once.			Big Ware, Cut more than once.		
	T.	c.	q.	T.	c.	q.	T.	c.	q.	T.	c.	q.
Challenge ...	13	15	1	13	4	1	11	5	0	11	13	2
British Queen	12	19	0	13	5	0	12	16	0	14	0	3
Conquest ...	12	7	1	...			10	13	1	...		
Royal Kidney	12	2	2	13	5	1	11	19	0	12	3	1
Charles Fidler	10	19	1	...			11	12	2	...		
Evergood ...	10	14	3	11	2	3	10	18	2	10	11	0
Up-to-date No. 2 ...	10	10	1	11	9	1	10	19	3	...		
Empress Queen	10	5	3	...			9	11	3	...		
Up-to-date ...	10	2	2	...			10	10	0	10	19	3
Goodfellow	8	7	1	9	1	0	8	7	1	...		
King Edward VII.	7	14	0	8	0	1	7	13	1	10	1	2

With the exception of Challenge, all the Varieties show increased crops from the use of selected seed—the average increase being slightly over $1\frac{1}{2}$ cwt.s. per acre. The advantage is perhaps comparatively little, but it must be remembered that in all cases the stock from which the seed was taken was grown only once at Garforth, and with the exception of that of Charles Fidler and King Edward VII. came from Scotland. With new seed, satisfactory crops may be expected without the necessity of selection on the above lines.

It is just possible, however, that selection might be of considerable benefit if carried out with Varieties after they had been grown for a number of years without change of seed.

With regard to the cut selected seed, it would appear that it is better to cut big ware several times than medium ware only once. In the case of the former the sections planted contained not more than two sprouts each, and, indeed, in most cases only one, whereas the sections of the medium ware had each several sprouts.

5. THE EFFECT OF MANURIAL TREATMENT UPON THE VIGOUR OF THE POTATO.

The question has arisen as to how far the method of growing Potatoes under the best cultural conditions, with the liberal aid of dung and artificials, may, in the course of a few years, be accountable for loss of vigour, and therefore, impaired cropping power. When the Potato is grown under the most favourable conditions there is an absence of that struggle for existence which is believed to have a beneficial effect upon the vigour of plant or animal. If, therefore, the conditions were less stimulating, it is only reasonable to suppose that greater vigour would be imparted to the tubers, and they would then be more valuable for seed purposes. If there be anything in this idea it would mean that only a proportion of the crop, sufficient to produce seed for the following year, need be subjected to exceptional treatment.

Accordingly, it was decided to grow, for a number of years in succession, without manure of any description, the same stock of Potatoes, to see whether the survivors of this severe treatment would prove more vigorous than seed produced under more favourable circumstances.

With this primary object in view, therefore, seed of Up-to-Date was reserved at Garforth, in 1904, from four differently manured plots. Incidentally also, the experiment would show whether the kind of manuring exerts any influence upon the productiveness of tubers in the succeeding year. It is only possible in this Report to state the results of one year's experiment. The following Table supplies particulars of the manures used on the different plots and the crops obtained in 1904.

	Plot	No.	Total Crop.	Tons. cwt. qrs.			Percentage Weight of Diseased Tubers.
	Plot 1.	No Manure	...	8	14	1	·30
	" 2.	20 tons Dung	...	13	11	1	1·77
	" 3.	10 tons Dung	...	12	1	2	2·10
	" 7.	{ 10 tons Dung 1 cwt. Sulphate of Ammonia 2 cwts. Super 1 cwt. Sulphate of Potash...}	{ ... 12 ... 12 }	8	1	...	·97

The Variety grown was Up-to-Date, obtained from Scotland in 1904. The test proper was begun in 1905 with seed drawn from these crops.

In 1904 it will be noted that the biggest crops were obtained from Plots 2 and 7, although Plot 3, manured with only 10 tons of dung fell short of the yield of Plot 7 by only $6\frac{3}{4}$ cwts. Plots 2 and 3, that received dung without artificials, had the highest percentage of diseased tubers.

The seed obtained from each of these four plots was stored in boxes throughout the Winter of 1904-05. In 1905 one-half (Lot I.) of the seed from each plot was planted without manure of any description, the other half (Lot II.) on land that received 10 tons Dung, 1 cwt. Sulphate of Ammonia, and 1 cwt. Muriate of Potash per acre.

Both Lots were planted on strong clay soil in the same field, and the following were the results :—

	LOT I. No Manure. 1905.			
	Plot 1.	Plot 2.	Plot 3.	Plot 7.
Manures used for 1904 Crop.	No Manure.	20 tons Dung.	10 tons Dung.	{ 10 tons Dung. 1 cwt. Sul. of Ammon. 2 cwts. Super. 1 ewt. Sul. of Potash.
Total crop per acre, 1905 ...	T. c. q. 8 6 2	T. c. q. 9 2 1	T. c. q. 8 14 3	T. c. q. 8 4 1
Percentage weight diseased... ...	10·94	15·78	12·67	13·69
LOT II. { 10 tons Dung. 1 cwt. Sul. of Ammonia. 1 cwt. Mur. of Potash. } 1905.				
Total crop per acre, 1905 ..	T. c. q. 10 7 2	T. c. q. 10 10 3	T. c. q. 10 19 1	T. c. q. 10 15 1
Percentage weight diseased... ...	11·70	12·71	11·56	11·44

It would appear from these results that the different systems of manuring in 1904 had no influence upon the productiveness of the seed in the following year, when grown either on manured or on unmanured land. Seed from both Lots has been reserved for trials in 1906, bearing on the same point.

The results of future experiments must be awaited, before it is possible to say whether cultural or other conditions have any effect upon the vigour of the tuber.

6. THE PLANTING OF SEED AT DIFFERENT DEPTHS.

It will be remembered that at Escrick a dressing of dung was applied to the "seeds" and ploughed in, in the Autumn of 1904. Early in the Spring of 1905 the land was ridged, and, some time before planting, the artificial manures were broadcasted on the ridges. The ridges were

shortly afterwards harrowed down so that the Potatoes might not be planted too deep. A potato digger is used at Escrick, and this implement works more satisfactorily and easily when the tubers are fairly near the surface.

In order to determine whether shallow planting has any effect upon the crop, a test was made at **Escrick** with seed of Scottish Triumph, direct from Scotland. Three rows (1/40 acre) were ridged up and the seed was planted on the smooth surface left by the sole of the plough. The rows were then split and it was estimated that the sets were quite five inches below the top of the ridge.

Seed from the same stock was also planted in three other rows which had previously been harrowed down. In these, the tubers rested upon loose, fine mould, and they were covered with little more than two inches of soil. In the course of the summer both lots were earthing up alike.

On July 6th, it was evident that the tops of the shallow planted potatoes were considerably stronger, taller, and more advanced in flowering than those of the more deeply planted potatoes.

The following crops were lifted :—

	Total Crop per acre.				Weight of Diseased Tubers per acre.		
	Tons.	cwts.	qrs.	lb.	cwts.	qrs.	lb.
Scottish Triumph (planted deep)	... 13	4	1	4	... 9	1	4
Scottish Triumph (,, shallow)	... 12	18	0	24	... 4	2	16

It will be seen that practically the same weight was lifted in each case, but the labour of harvesting was distinctly greater with the former.

It is somewhat strange that the deeper-planted Potatoes should have contained the greater weight of diseased tubers.

A similar test was carried out at **Garforth** with Up-to-Date twice previously grown on the farm.

Two plots received the following manures per acre immediately before planting :—

10 tons Dung, spread in the rows.
1 cwt. Sul. of Ammonia „ „ „
1 cwt. Muriate of Potash „ „ „

In one case the sets were planted on the top of the dung and the ridges at once split. In the other the ridges were lightly harrowed down, so that the dung was mostly covered before the sets were planted. The latter represented the shallow planting.

Two more plots, to which no dung was applied, were included in the test. They received 1 cwt. Sulphate of Ammonia and 1 cwt. Muriate of Potash per acre. In one plot the drills were harrowed down and the Potatoes then planted, in the other the Potatoes were planted on the mark made by the sole of the plough.

The following table gives the results :—

	...|	WEIGHTS PER ACRE.					
		Total Crop.			Diseased Tubers.		
		T.	c.	q.	lb.	c.	q.
Ordinary depth, dung and artificials	...|	9	19	1	4	10	2
Shallow planted	," , "	9	17	0	16	18	0
Shallow planted, artificials alone	...|	8	0	2	24	12	3
Deep	," , "	6	17	0	16	10	2

Whereas practically the same yield per acre has been obtained from the two plots that received dung, the shallow-planted plot, that received artificials only, has produced $23\frac{1}{2}$ cwt.s per acre, or 15% more than the deep-planted plot which received the same manures.

At Escrick the shallow-planting resulted in no increase, but it must be remembered that the soil there is quite different from the soil at Garforth. At the latter place it is a rather shallow, stiffish loam, in which the roots of deep-planted Potatoes would have difficulty in spreading, whilst at Escrick the soil is a deep, good-bodied sand, altogether less impenetrable than the soil at Garforth.

A moderate application of dung in the rows prevents the Potatoes from being planted too deep, but it is questionable whether it is good policy to use the same depth of drills for planting without dung.

7. DISEASES OF THE POTATO.

The Potato is subject to a number of diseases, only two of which, however, will be referred to in this Report.

(1) Scab.

Potatoes are frequently disfigured by the presence on the skin of rough, brown excrescences, generally known as scab. In some parts of Yorkshire, notably on sharp sand and gravelly soils, the malady is often so severe as to completely cover the skin and even penetrate into the flesh of the tuber. On clay soils it is practically unknown.

The cooking quality of the Potato is perhaps not impaired by a few blotches of scab—in severe cases it undoubtedly is—but the market value is considerably depreciated by even slight disfiguration of the tuber.

There is a great deal of uncertainty as to the cause of scab. By some it is said that injury to the skin induces a roughened or scabbed surface, and the trouble is therefore attributed to the presence of sharp stones, cinders, etc., in the soil. On the other hand, the disease is found on sorts where these things are not present, and most authorities are of opinion that scab is chiefly due to a parasitic fungus—*Oospora scabies*.¹ haxter.

Some assert that the fungus thrives best in an alkaline medium, and that consequently an application of lime to the soil increases the virulence of the disease. The same authorities aver that “acidity” in the soil checks scab, and the application of acid

manures, such as superphosphate, and the ploughing in of green crops are recommended as useful for bringing the soil into a sufficiently acid condition.

Finely powdered sulphur, spread in the rows at planting time, has for years been used by gardeners with more or less success for checking scab. In the Cleveland iron district the miners have for some time been in the habit of top dressing their Potato patches with "sulphur shale," a waste product obtained in layers overlying the ironstone, and it is said that the use of this substance has greatly reduced the amount of scab in that locality. The sulphur shale, which abounds in Cleveland, contains a considerable percentage of pure sulphur, and a quantity of it was obtained and applied to small areas at Garforth known to be infested with scab. In Cleveland the shale, which is comparatively soft, is applied to the land in winter, and by the influence of the various weathering agents it crumbles to a fine powder, and is then dug into the soil. Unfortunately, the shale for the Garforth trials was not obtained until planting time, and had to be crushed mechanically. In consequence, the state of division was not so fine as could be wished.

The sulphur shale was applied to a plot in the garden at the rate of 3 tons per acre on May 4th. Another plot received on the same date 3 tons per acre finely powdered quicklime, and a plot was left untreated.

All the plots received the following manures per acre:—10 tons Dung, 3 cwts. Super, 1 cwt. Sulphate of Ammonia, 1 cwt. Muriate of Potash. Badly scabbed seed was planted on May 4th.

The biggest weight of tubers was grown on the untreated plot, but the differences between the plots in this respect were practically insignificant. The tubers on all the plots were affected with scab to a like extent.

An experiment was also carried out on scab-infested ground in Field 36. The following dressings were applied at planting time:—

- Plot 1. 5 cwts. Salt per acre.
- “ 2. 4 tons Sulphur-shale per acre.
- “ 3. No treatment.

The plots received the following manures in the rows:—10 tons Dung, 1 cwt. Sulphate of Ammonia, and 1 cwt. Muriate of Potash.

Scabbed seed (Up-to-Date) was planted.

Examination of the plots in summer showed that although the crops on all the plots were more or less scabbed, the tubers on the Salt plot were decidedly the least affected.

Each of these plots gave practically the same weight of crop, and each crop was equally badly scabbed.

The Influence of Manures upon the Amount of Scab.—That the virulence of the disease is to some extent influenced by certain manures appears to be beyond doubt. Manorial experiments with Potatoes have been conducted in different parts of Yorkshire during the past seven years. In 1905 one of the experiments was conducted on Mr. Stobart's farm at Ellerker, near Brough. In this neighbourhood scab is frequently very prevalent. The following is the scheme of manuring, together with notes made on the appearance of the tubers when lifted:—

Plot 1	No Manure.	Very badly scabbed.
Plot 2	20 tons Dung.	Badly scabbed.
Plot 3	10 tons Dung.	Badly scabbed.
Plot 4	10 tons Dung. 2 cwts. Super. 1 cwt. Sulphate of Potash.	Scabbed.
Plot 5	10 tons Dung. 1 cwt. Sulphate of Ammonia. 1 cwt. Sulphate of Potash.	Scabbed.
Plot 6	10 tons Dung. 1 cwt. Sulphate of Ammonia. 2 cwts. Super.	Badly scabbed.
Plot 7	10 tons Dung. 1 cwt. Sulphate of Ammonia. 2 cwts. Super. 1 cwt. Sulphate of Potash.	Slightly scabbed.
Plot 8	10 tons Dung. 141 lb Nitrate of Soda. 2 cwts. Super. 1 cwt. Sulphate of Potash.	Scabbed.
Plot 9	10 tons Dung. 1 cwt. Sulphate of Ammonia. 2 cwts. Super. 99 lb. Muriate of Potash.	Scabbed.
Plot 10	10 tons Dung. 1 cwt. Sulphate of Ammonia. 2 cwts. Super. 450 lb. Kainit.	Very slightly scabbed.
Plot 11	10 tons Dung. 55 lb. Sulphate of Ammonia. 2 cwts. Rape Meal. 1 cwt. Sulphate of Potash.	Slightly scabbed.
Plot 12	2 cwts. Sulphate of Ammonia. 4 cwts. Super. 2 cwts. Sulphate of Potash.	Very badly scabbed.
Plot 13	110 lb. Sulphate of Ammonia. 4 cwts. Rape Meal. 4 cwts. Super. 2 cwts. Sulphate of Potash.	Very badly scabbed.
Plot 14	No Manure.	Very badly scabbed.

The crop least affected with scab was obtained where the mixture of manures included Kainit. An exactly similar result was obtained at Garforth in 1904.

The Tubers seem to become more and more scabbed the longer they are left in the ground. It was noted that when the late planted Varieties (see page 17) were lifted, the tubers were almost entirely free from scab, whereas the same Varieties planted alongside at an earlier date were, with the exception of Charles Fidler, practically scabbed all over. This would point to the advisability of early lifting where scab is prevalent.

Comparative scab-resisting powers of the Varieties.
Certain Varieties have more power of resisting scab than others. Potatoes of the Up-to-Date type seem to offer least resistance to attack.

The Variety Test at Garforth was conducted on soil known to be infested with scab, and the following table shows how the different sorts were affected with the disease :—

Variety.			Condition of tubers.
Charles Fidler	...	...	No scab.
King Edward VII.	...	...	"
Discovery	...	...	"
Evergood	...	...	"
Royal Kidney	...	...	Very slightly scabbed.
Empress Queen	...	...	Slightly scabbed.
Goodfellow	...	...	"
Northern Star	...	...	"
British Queen	...	...	Scabbed.
Challenge	...	...	"
Conquest	...	...	"
Factor	..	...	Badly scabbed.
Up-to-Date	...	...	"
Up-to-Date, No. 2	...	...	"

The following Varieties, viz., Dalmeny Beauty, Duchess of Cornwall, Wonder and Factor, grown from new seed, and all of the Up-to-Date type, were more or less badly scabbed on the loam portion of the field, whereas on another portion of the same field where the soil is a stiff clay these same Varieties were quite free from scab.

Charles Fidler, as a main crop Variety, seems peculiarly adapted for localities where scab is prevalent. It is, moreover, a heavy cropper, good disease ("demic") resister, and one of the best cooking Potatoes on the market.

(2) "The Potato Disease" or "Demic."

Undoubtedly the most common and the most malignant disease of the Potato is that known popularly as "The Potato Disease" or "Demic." The well-known symptoms are produced by a parasitic

fungus, but as its life history is still rather obscure, reference here will be made mainly to measures for preventing, or at all events for checking the disease.

The disease usually makes its appearance just when the Potatoes are approaching maturity, and is always most prevalent in moist, warm, and close weather. Hence we find that Varieties which ripen fairly early, and which are lifted as soon as ripe, suffer materially less from the disease than those that reach maturity late in Autumn, when the weather conditions are frequently well suited to the spread of the disease.

Pulling up the haulm directly the disease makes its appearance is sometimes suggested as a precautionary measure, but this, especially in a year when demic makes an early appearance, must lead to reduction of the crop and impaired cooking quality.

Spraying the growing crop with "Bordeaux" mixture has proved to some extent successful in preventing the disease.

It was resolved to try the effect of spreading in the rows at planting time, "Strawsonite" and Sulphate of Iron. The former has been used with good results for spraying the foliage. Conquest was the Variety selected for the test on account of its comparative liability to disease. The seed was selected from stock that had already been grown twice on the Farm, and would presumably, on that account, be more liable to disease than new seed.

The plots received the same manurial treatment as the rest of the field :—

	Total Crop per acre.				Percentage of Diseased Tubers.		
	T.	c.	q.	lb.			
No treatment	9	10	2	24	5·6
1 cwt. Strawsonite, per acre ...			9	17	0	16	4·8
1 cwt. Sulphate of Iron ,,	...		7	10	0	0	2·1

There was certainly less disease where Sulphate of Iron was applied, but its use was attended by a marked reduction in the yield of marketable produce.

It is questionable therefore whether the amount of demic can be profitably controlled by the application of chemicals in the row.

(3) Wet Rot.

Loss is also frequently sustained from rotting in the pies. This is chiefly attributable to the disease known as "Wet Rot" which is quite distinct from the "Potato disease" or "Demic." The characteristic signs of the latter are brownish coloured patches on the skins of the tubers, the discolouration at the same time penetrating into the flesh. "Wet Rot" readily attacks these "Demic" tubers in the pie, converting them into a soft pulpy mass; it also attacks sound tubers. "Demic," on the other hand, does not spread in the pie. (See Report No. 46).

It was shown also in that Report that rotting in the pies can be checked by freely dusting the tubers with finely powdered quicklime. In connection with the experiments, the question arose as to

whether the presence in the pie of either "wet-rot" or "demic" tubers, or of both, would have any prejudicial effect upon sound tubers to be used as seed.

During the Winter of 1904-5 similar experiments to those discussed in Report No. 46 were carried out at Garforth, and the full results will be published in due course. In the meantime, the plan of the experiments may be given, together with a statement of the yields obtained from seed drawn from the various pies.

New seed of Up-to-Date was procured from Scotland in the Spring of 1904, and from the crop produced, seed was selected in the Autumn and pied as follows :—

- Pie 1 = 16 stones sound tubers.
- „ 2 = 14 stones sound + 2 stones "demic" tubers.
- „ 3 = 14 stones sound + 2 stones "demic" + 7 lb. quicklime.
- „ 4 = 15 stones sound tubers + 1 stone "wet rot" tubers.
- „ 5 = 15 stones sound tubers + 1 stone "wet rot" tubers + 7 lb. ground quicklime.

The soil was removed from the pies on March 30th, 1905, and the tubers, which were all more or less sprouted, were transferred to boxes. Plots of equal area were planted on May 14th with sound seed from each of the pies, and the following were the crops produced per acre :—

			Tons.	cwts.	qrs.
Pie 1	...	...	11	4	0
„ 2	...	...	9	15	0
„ 3	...	...	9	14	0
„ 4	...	...	9	0	0
„ 5	...	...	9	12	3

It will be seen that the presence of either "demic" or "wet rot" in the pies has in some way materially reduced the yields. This is scarcely matter for surprise in the case of Pie 4, as it was noted at the opening of the pie that the sprouts of healthy tubers which had come in contact with "wet rot" were partially injured, and in some cases killed.

Although the nature of the season is the chief determining factor as to the prevalence of disease or demic, yet the farmer can to a certain extent minimise the danger of loss by change of seed.

8. CHANGE OF SEED.

Too much stress can hardly be laid on the importance of this point. New seed is unquestionably more disease-resisting than seed that has been grown on the same farm for a number of years, and to secure the biggest crops, apart altogether from the question of disease, it would seem to be necessary to introduce new seed every second or at most every third year.

The following tables give particulars of experiments conducted in 1903 bearing on those special points. (See Report No. 35.)

	OLD SEED. (Fourth year on farm.)			NEW SEED.			Balance in favour of New Seed.		
	Total crop per acre.			Total crop per acre.			T.	c.	q.
British Queen...	T.	c.	q.	T.	c.	q.	T.	c.	q.
British Queen...	11	16	0	13	12	2	1	16	2
Challenge ...	9	0	3	13	10	0	4	9	1
Conquest ...	8	19	0	11	17	2	2	18	2
Eightyfold ...	7	0	0	11	12	2	4	12	2

	OLD SEED. (Fourth year on farm.)			NEW SEED.		
	Weight of Diseased tubers per acre,	Percentage of Crop Diseased,				
Challenge ...	T. 3	c. 0	q. 0	33.19	No diseased tubers.	
British Queen ...	2	0	3	17.26	Do.	
Eightyfold ...	1	15	0	25.00	Do.	
Conquest ...	1	4	3	13.82.	Do.	

Whilst it is probable that Scotland affords the best change of seed for Yorkshire, considerable benefit may also follow a change from different parts of England, especially if the soil, off which the seed comes, differs in character from the soil in Yorkshire. In 1904, new seed of Charles Fidler obtained from Messrs. Fidler & Sons, of Reading, and, as far as could be ascertained, grown in the South of England, produced a better crop, by 6 tons per acre, than seed of the same Variety grown the third year at Garforth without change.

In 1902, seed of Wonder, a variety of the Up-to-Date type, was obtained from the East Riding, and has since been grown at Garforth without change. New seed from the same place was grown at Garforth in 1905, and the following is a comparison of the crops:—

	Yield per acre.	Percentage			Percentage diseased.
		T.	c.	q.	
Wonder (fourth year on farm) ...	11 13 2	71	5		
“ (new seed) ...	12 14 0	88	1		

The soil in the East Riding on which Wonder was grown is a rich heavy loam of fine texture; at Garforth the soil is of a lighter character.

The following results, also obtained in 1905, confirm those already given :—

NAME OF VARIETY.	YIELD PER ACRE.						DISEASED TUBERS PER ACRE. (Lb.)				
	Second Year on Farm.			Third Year on Farm.			Balance in favour of the Newer Seed.	Second Year on Farm.			
British Queen...	T. 12	c. 19	q. 0	T. 11	c. 13	q. 1	T. 1	c. 5	q. 3	<i>Nil.</i>	160
Conquest ...	12	7	1	9	10	3	2	16	2	120	1,200
Royal Kidney...	12	2	2	11	11	2	0	11	0	<i>Nil.</i>	40
Charles Fidler...	10	19	1	*6	19	1	4	0	0	440 (1·7 %)	240 (1·5 %)

* Fourth Year on Farm.

It is well to point out that new seed should be obtained as early in Spring as possible, before sprouting has commenced, so that the damage which sprouted Potatoes suffer in course of bagging and transit may be avoided.

NEW VARIETIES FOR 1906.

Small quantities of new seed of a number of Varieties hitherto untried at Garforth were planted in 1905, to provide sufficient seed for a proper test in 1906.

The following yields were obtained from some of the Varieties :—

			Tons.	cwts.	qrs.	
Wonder (East Riding seed) ...	...	...	12	14	0	per acre.
Duchess of Cornwall (Scotch seed) ...	...	...	12	10	3	"
Factor (Scotch seed) ...	...	...	11	15	3	"
Duchess of Cornwall (West Riding seed) ...	...	...	11	8	1	"
Dalmeny Regent (Midlothian seed) ...	...	...	11	3	4	"
„ „ Beauty „ „ „	...	...	10	18	2	"

Dalmeny Acme, Dalmeny Jewel, Stuntney King Cole, Stuntney Surprise, Eldorado, Peacemaker, Harbinger and Recorder were also grown, but on areas so small that a reliable comparison with the yields of the other Varieties could not be made.

SUMMARY.

The following conclusions may be drawn from the experiments :—

1. Taking into consideration yield, cooking quality, and power of resisting disease, the following, in 1905, were the best Varieties :—

British Queen, Conquest, Royal Kidney, Factor, Up-to-Date, Charles Fidler, and King Edward VII.

The best disease resisters were:—

Evergood, Discovery, and Royal Kidney.

2. The longer Potatoes are left in the ground after they are ripe, the greater will be the proportion of diseased tubers. Least loss is therefore sustained when Potatoes are lifted as soon as ripe.

3. Seed Potatoes should be removed from the pie or clamp as soon as they show signs of sprouting.

4. Where early planting is not possible, the boxing of Seed Potatoes has proved decidedly profitable.

5. Immature seed has given slightly better crops than mature seed.

6. The practice of planting, year after year, small Potatoes from the same stock, undoubtedly tends to diminished yields.

7. The selection of seed from the most prolific roots does not materially increase the yield when practised with *new* seed, but may be of considerable value with old seed.

8. Potatoes are just as suitable for seed when grown by the aid of one kind of manure as by another.

9. When no dung is applied in the row in Spring, care should be taken that the Potatoes are not planted too deep.

10. Certain manures used along with Dung seem to have the effect of checking scab; of these, Kainit has given the best results.

11. Certain Varieties, notably Charles Fidler, are less liable to scab than others.

12. Diseased tubers in the pie seem to affect adversely the productiveness of sound tubers with which they have been in contact.

13. Seed should be changed frequently. It is important to obtain it before sprouting has commenced.

J. G. STEWART.

THE UNIVERSITY,

LEEDS, 1st February, 1906.

THE UNIVERSITY OF LEEDS.

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